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The Flying Column:
A Concept for Tactical Nonlinear Sustainment

A Monograph
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ABSTRACT

THE FLYING COLUMN: A CONCEPT FOR TACTICAL NONLINEAR SUSTAINMENT by MAJ James M. Castle, USA, 52 pages.

As modern battlefields have become increasingly dispersed and nonlinear, intermingling of opposing forces in encounter battles jeopardizes the sustainment of maneuver forces along fixed lines of communication. During the mid-nineteenth century, French and American armies developed the "flying column." This formation was a self-sustained, combined arms force that was able to operate independently of fixed lines of communication for predetermined periods of time. The purpose of this monograph was to assess the utility of the flying column concept for tactical sustainment on the modern nonlinear battlefield in a mid- to high-intensity environment.

In this study, I trace the evolution of modern warfare to define nonlinearity and describe its effects on tactical sustainment. I describe the development of the flying column concept in the nineteenth century, and examine contemporary uses of a similar sustainment concept in mid- to high-intensity conflicts. I assess the characteristics and effectiveness of the flying column based upon the historical examples using the sustainment imperatives of AirLand Battle (anticipation, integration, continuity, responsiveness, and improvisation). Finally, I examine current and emerging U.S. Army sustainment doctrine to determine their sufficiency for nonlinear sustainment, and compare them to the flying column concept.

I conclude in the monograph that current and emerging U.S. Army doctrine for tactical sustainment is still largely linear in concept and is highly dependent upon secure lines of communication. By contrast, the accompanying sustainment of the flying column concept could provide the independence and endurance required of tactical units on the modern nonlinear battlefield.

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I. INTRODUCTION

The tanks and infantry fighting vehicles of Task Force 1-78 halted amidst the smoking wreckage of Objective HAMMER. Surviving enemy forces had broken contact and withdrawn to the south, but TF 1-78 was in no condition to pursue. Tank and ATGM[*] rounds were depleted, and fuel was low as well. The fierce firefight had not been without losses of vehicles and crewmen. Both required evacuation. The executive officer called back to the forward support area of the brigade for immediate resupply, medical evacuation, and maintenance and recovery support.

Within minutes of receipt of TF 1-78's request, a LOGPAC[**] departed the brigade's forward support area thirty kilometers to the rear. Based on anticipated consumption, a mix of several ammunition types had been preloaded on HEMTTs[***] of the forward support battalion. Fuel trucks, heavy equipment transporters, ambulances, and hot rations accompanied the ammunition HEMTTs. These wheeled vehicles found the movement forward slow going, stopping frequently to await battle wreckage to be cleared from the road, or detouring around craters and blown bridges.

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[*]ATGM--Antitank guided missile.

[**]LOGPAC--Logistics package: preconfigured truck column with essential items of resupply and sustainment.

[***]HEMTT--Heavy expanded mobility tactical truck: variants carry ten tons of cargo or 2,500 gallons of fuel.

The battalion S-4 stopped the column at one such crater across a narrow road through a patch of woods. As he got out of his HMMWV* to survey the situation, the woods erupted with a hail of light cannon, small arms, and RPG** fire. The thin-skinned support vehicles exploded one after another, the few heavy machine guns among them powerless against concealed infantry and armored fighting vehicles.

Three hours after halting on Objective HAMMER, the commander of TF 1-78 learned of the destruction of the LOGPAC. Another was on its way, accompanied by attack helicopters and a mechanized combat force, but the commander swore at the delay. The MCS*** terminal in the operations track sawed out a startling message. Airborne and ground sensors indicated movement of four suspected enemy formations converging on his position.

This scenario demonstrates the unique problems the increasingly dispersed modern battlefield offers to maneuver forces and sustainers alike. Ever more deadly weapons have dispersed forces, making intermingling of friend and foe inevitable. On such a nonlinear battlefield, traditional use of fixed lines of communication will be tenuous at best.

During the early nineteenth century, French and Ameri-

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*HMMWV--High-mobility multipurpose wheeled vehicle.

**RPG--Rocket propelled grenade.

***MCS--Maneuver control system: automated information terminal.

can armies developed the "flying column."[1] This formation was a self-sustained, combined arms force that was able to operate away from fixed lines of communication for predetermined periods of time.[2] The purpose of this paper is to assess the utility of the flying column concept for tactical sustainment on the modern nonlinear battlefield in a mid- to high-intensity environment.

This study will look at the evolution of modern warfare to define nonlinearity and analyze and compare concepts for sustaining tactical operations on nonlinear battlefields. What are the factors that have expanded the distances of the battlefield while shortening time? How have these factors affected the ways that combat forces could or should be sustained?

I will document the development of the flying column over the past century and a half, demonstrating the historical uses of this concept. Who has tried to fight a nonlinear war, and how did they sustain their forces?

Finally, I will assess the effectiveness of the flying column concept based upon the historical examples. Did it work? If so, why? Could it work today? How does it compare to current U.S. Army sustainment doctrine, and to emerging concepts of warfighting in the future?

Review and assessment require criteria to determine effectiveness. FM 100-5, Operations, offers five sustainment imperatives for AirLand Battle, our current warfighting

concept. Effective sustainment anticipates, integrates, is continuous and responsive, and improvises.[3]

* Anticipation. How well have armies foreseen their logistical requirements?
How have they organized their maneuver and sustainment forces to achieve their tactical goals?

* Integration. How well have armies brought together their maneuver and sustainment forces synergistically to provide combat power?

* Continuity. How have armies best ensured minimal disruption of sustainment during fluid conditions of battle?

* Responsiveness. How have armies been able to "surge" their sustainment effort to provide the right support at the right time and place?

* Improvisation. When the unexpected happens, how flexible has the sustainment apparatus been to adjust to changes?
How imaginative and resourceful have been the responses?

Though these criteria are largely subjective, they offer a means of comparison of the effectiveness of variant concepts and conditions for sustainment. I will apply these imperatives to the historical examples of nonlinear sustainment and to current and emerging U.S. Army sustainment doctrine to assess how effectively they support the tactical mission.

As war becomes increasingly complex, we look to history and theory to provide insights for the future. The classical theorist Carl von Clausewitz described theory as "an analytical investigation leading to a close acquaintance with the subject: applied to experience--in our case, to military history--it leads to familiarity with it."[4] With

that in mind, this examination will proceed from a theoretical understanding of nonlinear war through historical applications and analyses to conclusions about effective sustainment.

II. THEORY OF NONLINEAR WARFARE

Modern nonlinear warfare is a function of the increasing dispersion of forces across the battlefield. Nonlinearity has always been a characteristic of irregular warfare, but the combination of lethality of weapons, mobility of units, and the expansion of information has brought nonlinearity to the mid- to high intensity battlefield. Furthermore, the many contingencies facing our increasingly reduced forces have contributed to greater dispersion of those forces.[5]

Technological innovations in weapons of the mid- to late nineteenth century spelled an end to the squares and phalanxes that had characterized tactical formations since antiquity. Accurate, long-range fires from rifled muskets slaughtered massed infantrymen or cavalry.[6] Breech-loaded and magazine-fed repeating rifles permitted soldiers to sustain high volumes of fire from behind protected firing positions, even in an attack.[7] The machine gun and high explosive artillery added to this to create a virtual "wall of steel" through which an unprotected soldier moved with little hope for survival.[8]

The reaction to this lethality was to disperse troops and to dig in for protection. This led to the trench warfare of World War I that literally entrenched Europe from Switzerland to the North Sea, and cost an estimated twelve million lives in over four years of exhaustive attrition warfare.[9]

Following World War I, Germany and the Soviet Union developed strategies and tactics that maximized the capabilities of technological innovations of that war--the tank, the airplane, and the truck--to restore maneuver to the battlefield.[10] In World War II, they concentrated these assets to penetrate forward defenses, and then dispersed, driving deep into the enemy's more lightly protected rear, attacking him from all directions simultaneously.

The advent of nuclear weapons at the end of World War II continued the trend toward dispersion by making massed forces targets for annihilation. In response to this, the "Pentomic" U.S. Army of the 1950's was designed to fight by dispersed, virtually independent battle groups built around combined arms battalion task forces.[11]

Detente between the West and the Soviet Union in the 1970's and 80's led away from a necessarily nuclear conflict. But technological advances in conventional weapons lethality and precision, coupled with sophisticated targeting systems, have led to a destructive capability approaching nuclear dimensions.[12] These highly accurate and de-

structive fires have renewed emphasis on dispersion of forces for survivability, massing fires on enemy concentrations, then maneuvering to mop up survivors.[13]

Nonlinearity, then, results from the inevitable intermingling of opposing forces on such a fluid and widely dispersed battlefield. Adversaries will attempt to destroy concentrated formations by fires approaching nuclear lethality; then they will maneuver against dispersed units to isolate them and destroy them in detail. The results of this "swirling maelstrom" will be a battlefield on which there are neither front nor rear, units will rarely be capable of mutual support of flanks, and lines of communication will be intermittently secure at best.

Historically and theoretically, armies have been highly reliant upon secure lines of communication. The classical theorists, Clausewitz and Jomini, both described the careful planning and preparation generals must give to selecting, developing, and protecting their bases of operation and the lines of communication (LOC) leading forward to the army in the field.[14] Even Napoleon, who has enjoyed a reputation as a consummate forager, stockpiled rations and ammunition prior to two of his major campaigns.[15] Clausewitz and Jomini also stressed the significance of lines of communications of the enemy as a vulnerability. Interdiction, or even the threat of interdiction, of the enemy's lines of communication could turn him out of strong positions or

force has surrender, though his combat forces may yet be strong.[16]

The dispersed, mobile, and highly lethal nature of modern nonlinear warfare and its effects upon lines of communication pose several problems for sustainment. Particularly significant challenges are extended distances; increased volumes of logistical requirements; and security of routes, forces, and materiel. The sustainment imperatives provide critieria for the following assessment of the impact of these conditions upon tactical sustainment.

The modern, nonlinear battlefield greatly increases the length of LOCs with the sustainment sources in the rear. Current depth of the corps battle area is up to 200 kilometers and 80-100 kilometers wide.[17] The scenario for a possible future corps area of operations posits an area that may be up to 300 kilometers wide with a depth of 450 kilometers.[18] The time and space considerations suggested by these distances will demand greater anticipation. Unexpected requirements may take too long to move forward. Furthermore, greater distances often strain limited transportation assets due to extended turnaround times of missions. These effects may combine to reduce responsiveness and continuity of support. An attendant challenge is the wide dispersion of units throughout the battlefield. This will require greater redundance of means of distribution since there will be less collocation of forward units.

The volume of supplies, particularly fuel, often increases with distance. The Red Ball Express that provided fuel to General George Patton's Third Army in World War II consumed nearly as much gasoline as they were able to deliver forward.[19] Moreover, the heavy concentrations of fire likely in future war will require burgeoning volumes of munitions, and the destruction caused by enemy fires may increase both personnel and materiel losses and damages. In order to provide responsive and continuous sustainment, logisticians must anticipate these volumes and ensure that they plan for adequate means of distribution.

The most vexing challenge posed by nonlinearity is security of LOCs. The extended distances, wide dispersion of units, and likely intermingling of friendly and enemy forces places LOCs under constant threat to enemy fires, maneuver, and special operations forces. Indeed, they are priority targets for these forces. The issue of LOC security affects all of the sustainment imperatives. It demands anticipation of threat and countermeasures, as well as organization for support and operations. It threatens the integration of sustainment and operations as synergistic combat power by disrupting continuity and responsiveness of support. Finally, it will require often extraordinary measures of improvisation in order to overcome the effects of interdiction of LOCs or destruction of sustainment assets.

But neither nonlinear battle nor its sustainment are

new to the history of warfare. As modern nonlinear warfare has evolved, a parallel evolution of sustainment concepts has contributed to endurance of maneuver formations on such battlefields. Examination of past and recent historical examples reveals a recurring sustainment concept of supporting nonlinear battle--the flying column.

III. HISTORICAL BACKGROUND

Irregular warfare is by its nature nonlinear. Irregular forces seek to avoid the superior combat power of their enemy, relying upon mobility and concealment to strike isolated outposts where they can achieve local superiority. Such was the situation Marshal Thomas-Robert Bugeaud found in North Africa in 1836 when he arrived from France.[20] Arab tribesmen were free to roam at will avoiding fortified French outposts and the ponderous Napoleonic columns that moved against them.[21] Bugeaud proposed divesting the columns of heavy artillery and baggage wagon trains. Essential rations and ammunition would be packed by mules, and the soldiers themselves would carry four days of supplies.[22] These mobile columns of up to 6,000 troops would be self-sustaining for up to fourteen days.[23] As Bugeaud applied these new formations, they permitted the French forces to equal the mobility of their enemy and to use their superior firepower decisively.

This concept emerged again in the American Civil War.

Union logisticians discovered that their dependence upon fixed lines of communication restricted the mobility and flexibility of their army. By March, 1863, the Army of the Potomac had grown to 163,000 men.[24] It found itself tied to the rail lines that moved the huge quantities of supplies it consumed. Though General George B. McClellan and his successors tried several imaginative approaches to flank or envelop Confederate General Robert E. Lee's Army of Northern Virginia, the lines of communication required to support these efforts either failed to provide adequate sustainment or were threatened with interdiction by Lee's far-ranging cavalry.[25]

Early in 1862, Montgomery Meigs, the Union Quartermaster General, discovered the French flying column concept and distributed a proposal for lightening the trains of the armies.[26] These, he proposed, would allow the armies to move more rapidly, operate away from support bases and rail lines for up to eight days, and reduce the insupportable wagon and team requirements of the armies.[27] The Army of the Potomac implemented these proposals for General Joseph Hooker's campaign in western Virginia in the spring of 1863, culminating with the battle of Chancellorsville.[28] The concept worked well, and with refinements, was used again in late June to enable the army to deploy towards Gettysburg much more rapidly than Lee expected.[29] Of some interest is the fact that Lee also used a similar logistic concept and

organization for the Gettysburg campaign.[30]

Meanwhile, in the West, General U.S. Grant used the flying column concept to create true nonlinearity. Stymied by strong linear defenses at Vicksburg, Mississippi on the Mississippi River, Grant chose an unprecedented strategy. Sailing south past the guns and defenses of Vicksburg, and marching down the secure west bank of the river, he disembarked twenty miles south of the city. Abandoning his LOCs and carrying only minimal rations and ammunition, Grant circled behind the enemy's defenses and cut his lines of communication. Vicksburg fell after a siege on July 4, 1863.[31] This lesson was not lost upon General William T. Sherman, one of Grant's corps commanders. He used a similar concept and organization during his march across Georgia and the Carolinas later in the war.[32]

The flying column permitted the Union armies to achieve the mobility required ultimately to dismember the Confederacy. Able to sustain themselves away from river and rail lines of communication in the more sparsely populated West and deep South, they slashed across the South, separating the Confederate armies from their sources of sustainment.

Although uses of the flying column concept contributed to nonlinear maneuver during the nineteenth century, advances in weapons technology of the mid- to late nineteenth century led to a paradigm of entrenched linearity by World War I. But the advent of motorization during that same

conflict began innovations in maneuver warfare during the 1920's and 30's. Though the British proposed seminal concepts for the use of tanks and airplanes to restore maneuver to the battlefield, Germany and the Soviet Union were the countries that developed organizations, equipment, and doctrine to accomplish this.[33] Included in their operational and tactical concepts was sustainment of highly mobile maneuver units by a flying column concept.

During the 1930's, Germany developed a strategy of shock and maneuver to prevent or break the stalemate of linear fortifications. Known during World War II and since as *blitzkrieg* (lightning war), it employed massed armored formations to create penetrations in enemy defenses. While following units enlarged the shoulders of the penetrations, the armored formations continued to drive deep into the enemy's rear, destroying his reserves, cutting LOCs, and breaching secondary defenses.[34] (Figure 1)

Deep forays into the enemy's rear area demanded unique means of sustainment. Penetrating and exploiting *Panzer* divisions carried with them "a double weight of ammunition" (two basic loads in our terminology).[35] German fighting vehicles were designed for a range of 180 miles with on board fuel capacity including discardable auxiliary tanks. Fuel trucks accompanied these units with sufficient fuel for an additional 100 miles.[36] Units subordinate to division conducted emergency maintenance on vehicles during battle or

evacuated equipment to more static division workshops displacing by bounds behind the division.[37] Essential medical treatment and evacuation services were well forward with the fighting troops.[38] During penetration and exploitation, troops subsisted on "iron rations", a cold combat ration that they carried in sufficient quantities on the fighting vehicles.[39]

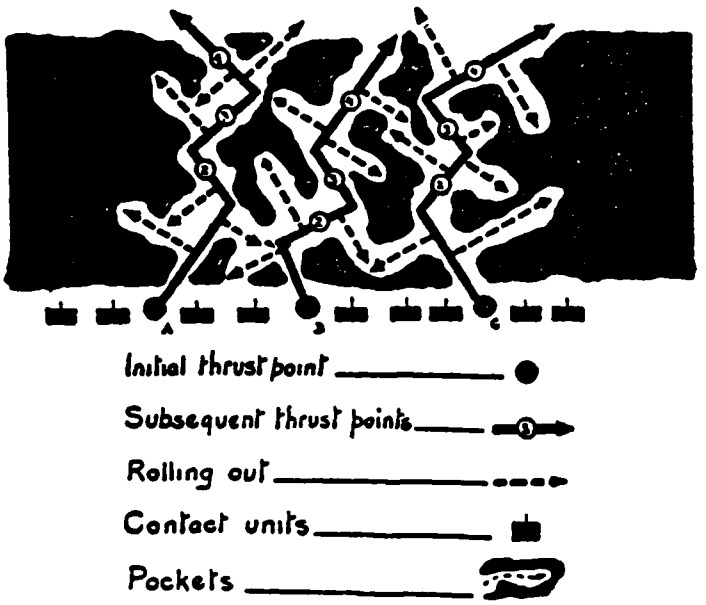

Figure 1. German Penetration and Exploitation (*Schwerpunkt* and *Aufrollen*). Reprinted from Miksche, Attack: A Study of Blitzkrieg Tactics, 16.

Sustainment difficulties the Germans encountered during World War II were largely failures at the operational and strategic levels. During the invasions of Poland, the Low Countries, and France in 1939-40, road congestion and rail traffic priorities often delayed replenishment of forward units.[40] In Russia and North Africa, extremely extended LOCs and woefully inadequate means of transportation com-

bined to strangle the support of units in contact.[41]

The Soviet Union has demonstrated the most consistent development of conventional nonlinear warfare and sustainment in recent history. Along with the Germans, they focussed post-World War I development on restoration of maneuver to the battlefield. They employed forward detachments and mobile groups--tailored, highly mobile, combined arms units--to exploit penetrations and drive deep into the enemy's rear to seize operational objectives.[42] As they developed the organizations to fight this nonlinear concept, they integrated a flying column means of sustainment.

The Red Army initially achieved tactical self-sufficiency through draconian austerity. Only that which was essential for fighting accompanied these forward detachments and mobile groups, primarily ammunition and fuel. German General F.W. von Mellenthin described Soviet sustainment during World War II:

> ...[The] supply columns of the Red Army do not have to worry about clothing, tents, blankets and many other items regarded as essential in the West: during an advance they can afford to forget about rations, for the troops "live off the country." The chief task of the supply columns is the movement of gasoline and ammunition, and even these items are frequently packed on what a Western army calls "fighting vehicles. In a Russian motorized division, the soldier has no luggage apart from what he carries on his person. Somehow or other he squeezes on to a vehicle packed with gasoline and ammunition.[43]

The Soviet Union began World War II critically short of rail and motor transport. Although they were producing essential munitions and supplies, they suffered severe dis-

tribution problems during the early years of that conflict. By 1943, however, shipments of locomotives and rail cars and thousands of Studebaker trucks from the United States began to turn the logistical tide.[44] As the resources became available, the Soviets mechanized not only their maneuver forces, but their sustainment effort as well. This reorganization "...enabled their mobile forces to be self-sufficient for five days and to travel at least one hundred miles without replenishment if necessary."[45] These accompanying supply columns permitted the deep attacks that shattered and encircled the retreating Germans.

The Soviet Army since World War II has continued to develop their tactical self-sustainment capability. Soviet fighting vehicles are designed for an operational range of up to 600 kilometers unrefueled.[46] Accompanying supplies of ammunition and fuel are fully mobile and are prestocked according to the norms of the proposed mission. Divisions normally stock three to five days of essential supplies.[47] Vehicle maintenance forward is limited to emergency repairs to restore mobility. Major overhauls or replacement of major assemblies occur at division, army, or *front*.[48] Medical support consists of minimal treatment forward and rapid evacuation,[49] but under fluid conditions, wounded may have to be carried along until the situation stabilizes.[50]

As nonlinear war has developed over the last two centuries, several nations have successfully used the flying

column concept of sustainment to enhance combat power. Limited self-sustainment of maneuver forces has enabled armies to prosecute attacks deep into enemy rear areas by-passing linear defenses and strongpoints to wither, surrender, or be destroyed from behind. Looking at the common characteristics of these historical examples, we can define the flying column concept, and compare it to other contemporary sustainment concepts.

IV. ANALYSIS AND COMPARISON

Characteristics of the Flying Column

The sustainment organizations and doctrines of the armies of the historical examples cited reveal many similarities. These similarities describe the characteristics of the flying column--limited independence, austerity, mobility, and security.

The flying column, in each of the cases above, was designed to operate independently of fixed sustainment bases or continuous lines of communication with those bases. Given tactical objectives deep in enemy territory, either significant combat power must be dedicated to keeping lines of communication open, or LOCs must be abandoned, requiring forces to take everything needed with them for the accomplishment of the mission. The flying column concept permits economy of force and concentration by exercising the latter option.

Nevertheless, independence is limited by the dynamic between depth of maneuver and endurance. Obviously, the more a force takes with them, the longer they can operate before requiring outside replenishment. But, the more they take, the larger and slower they will be, which could compromise the agility required to fight in contested or enemy controlled territory.

The characteristic of limited independence requires a carefully considered balance of accompanying resources based upon the considerations of METT-T (Mission, Enemy, Terrain, Troops, and Time). This will normally result in the tailoring of forces and sustainment according to the length of time anticipated for the accomplishment of the tactical mission.

Marshal Bugeaud tailored his columns to be self-sustaining for up to fourteen days.[51] He based this organization on the length of time he estimated was required to prosecute engagements with the enemy, the distance between French enclaves where he could replenish his forces, and the physical endurance of his soldiers.[52] General Meigs of the Union Army designed his flying column to be self-sustaining for eight days, which he determined would permit the Army to maneuver, fight, and restore or establish new lines of communication.[53] Depending upon the supplies available by foraging, that time could be significantly extended, as demonstrated by Grant at Vicksburg (20 days)[54] and Sher-

man's march across Georgia (29 days)[55].

During World War II, German *Panzer* divisions were also tailored for independent operations, maintaining three to five days of supplies. However, they also made use of captured supplies, especially fuel, in order to maintain the momentum of their deep attacks.[56] Erwin Rommel's 7th *Panzer* Division sometimes drove more than 100 miles a day during the pursuit through France in June 1940, far outstripping the corps and army supply lines.[57] Currently, regimental and division forward detachments of the Soviet Army are configured to be self-sustaining for two to three days and three to five days respectively.[58]

Austerity has been a means of attaining independence, mobility, and security by taking only mission essential sustainment resources along in the flying column. In all of the historical examples cited above, sustainment planners ruthlessly cut assets that contributed no significant combat advantage in order to enhance mobility. Bugeaud left his heavy artillery behind. Meigs slashed tentage and personal baggage of even field commanders and their staffs.[59] Besides von Mellenthin's description of Soviet austerity, as recently as 1982, a Soviet Army defector described Soviet sustainment:

> ...the Soviet soldier is not issued a sleeping bag, and does not need one. He can be left unfed for several days. All that he needs is ammunition...The problem of supplying Soviet troops in battle is thus confined to the provision of ammunition."[60]

The corollary of austerity is sufficiency. The sustainment imperatives require that sufficient sustainment accompanies the column to provide a reasonable margin for successful accomplishment of the mission.

The sustainment assets of the Soviet forward detachment are indicative of those that might accompany the modern flying column. Commonly, those assets are combat rations (Class I), fuel (Class III), ammunition (Class V), maintenance, and medical support. Maintenance is typically restricted to repairs that can be completed within a few hours at most in order to restore mobility or firepower. Equipment requiring excessive repairs may be abandoned to await follow on forces, rather than slowing the unit by pulling it behind. Casualties, if they cannot be evacuated by air, may have to accompany the column until it links up with follow on forces, but surgeons and qualified medics are found at the regimental and battalion levels respectively.[61]

Austerity combines with the fastest means of transport available to provide the flying column with mobility. The French army in Algeria, and the Union armies of the Civil War minimized the number of slow, heavy wagons used to transport materiel, substituting mules to the greatest extent possible.[62] The trains of the spearhead *Panzer* divisions of the *Wehrmacht* in World War II were entirely motorized, in contrast to the slower, horse-drawn wagons and pushcarts of infantry divisions.[63] The Red Army was only

able to create the deep penetrations and encirclements of the Germans on the Eastern Front when they received enough trucks from the United States to permit motorized sustainment.

Security, of course, is a key consideration for any military force. But for sustainment on the nonlinear battlefield, the flying column offers unique aspects of security. Lines of communication to forward units are extremely vulnerable, passing, as they do, through uncontrolled, contested, or enemy controlled territory. Historically, armies have dedicated forces to securing their lines of communication, even at the expense of combat power forward. Clausewitz pointed out the drain that LOC security imposes on an army: "Overall strength [of the attack] is depleted...by the invading armies' need to occupy the area in their rear so as to secure their lines of communication and exploit its resources."[64]

The flying column, however, provides security to its sustainment assets by their integration with combat forces in the column. Not only are combat elements dedicated to flank and rear security encompassing the trains, but the proximity of the trains to the main forces enhances their security. There is a "draft" effect created by the passage of a combat force that pushes disorganized enemy elements out and away from the column. By the time they can reorganize to counterattack, the mobility of the column may have

carried the more vulnerable support elements beyond danger.

There is, perhaps, another option for security of sustainment which involves a variation of the flying column. That is to provide a combat force to "ride shotgun" accompanying a supply column moving through unsecured territory between the logistics base and forward combat units. This formation would be a flying column in itself, sustainment heavy, but providing sufficient combat strength to fight through most threat forces likely to be encountered between the rear base and the forward units. However, this still poses the risk that the combat force may not be sufficient for the threat, and it bleeds away combat power that may be better employed elsewhere.

German General Hasso von Manteuffel testified to the effectiveness of Soviet flying column security: "You can't stop them, like an ordinary army, by cutting their communications, for you can rarely find any supply columns to strike."[55]

Assessment of the Flying Column According to the Sustainment Imperatives of AirLand Battle

The sustainment imperatives of AirLand Battle provide a measure of the effectiveness of the flying column concept of sustainment of nonlinear battle and a means of comparison with other sustainment concepts.

Anticipation of sustainment requirements according to METT-T provides the basis of the tailored structure of the

flying column. It considers the mission, the sustainment required to get the force to their objective and to secure that objective upon arrival. It accounts for the enemy threat, securing sustainment assets by encompassing them in the mobile combat column. The flying column is not as terrain dependent as linear concepts of sustainment, in that sustainment is not bound to fixed lines of communication with their attendant vulnerabilities to interdiction. As indicated, the flying column takes only the sustainment troops and resources required for the mission and the sustainment of the specific combat troops of the column. Finally, the flying column is designed for a predetermined length of time, accepting risk if the time required for the mission should exceed accompanying sustainment resources.

The flying column fully integrates maneuver forces and sustainment synergistically to achieve and maintain combat power in a nonlinear scenario. The organization of the flying column is an all arms structure tailored for its mission. It assumes that, on a nonlinear battlefield, it may have to fight independently for a predetermined length of time; so it takes along the essential elements of the battlefield operating systems needed, including combat service support (CSS).

Integration of combat service support with the maneuver and fires elements ensures endurance of combat power. Accompanying sustainment extends firepower beyond the basic

loads of the fighting vehicles. It permits depth of maneuver by refueling and materiel repairs. It maintains personnel strength through limited troop support and medical functions.

Integration of sustainment with combat elements in the flying column provides security for the more lightly armed and armored sustainment elements. Proximity to the fighting systems and the inherent mobility of the flying column reduce the vulnerability of sustainment assets to other than combat forces that are superior to those of the column.

Continuous support from rear sustainment bases may be impossible on the nonlinear battlefield during certain phases of the operation. Intermingling of friendly and enemy forces could sever lines of communication with the rear. But the flying column permits continuity within the time and resource parameters of its mission design. Accompanying sustainment avoids the interruption of support that interdiction of extended lines of communication could entail.

Furthermore, accompanying sustainment permits the combat commander to maintain momentum and initiative. He does not need to wait for replenishment to be pushed forward before continuing his maneuver. The internal continuity of sustainment of the flying column allows him to maintain a time critical advance or to pursue or exploit an enemy who has begun to collapse. It gives him a decisive advantage over an opponent who is dependent upon replenishment from

the rear along fixed lines of communication, especially if he can cut those lines, as Grant did at Vicksburg.

Closely related to continuity is responsiveness of support. Obviously, discontinuous sustainment would also be unresponsive, so the integration of support assets in the flying column allows rapid sustainment even on the nonlinear battlefield where continuous lines of communication may not be maintained. Similarly, accompanying sustainment is far more responsive to the developing conditions of battle and permits the flying column commander greater agility to seize or maintain initiative. Rommel's 7th *Panzer* Division was able to continue his deep thrust into France in 1940 in part because of the sustainment assets that accompanied his tanks and motorized infantry.

Flying column sustainment permits the improvisation required to adapt to the rapidly changing conditions of nonlinear battle. Innovative logisticians in the flying column are able to recognize and use sources of sustainment that may be encountered en route. Foraging is an ancient logistical art, and the modern flying column sustainer will use compatible captured supplies, equipment, and facilities whenever possible to extend his limited resources. After abandoning his lines of communication at Atlanta, General Sherman arrived in Savannah, Georgia with more animals and wagons than when he left.[66]

Current U.S. Army Sustainment Doctrine and Nonlinearity

FM 100-10, Combat Service Support, recognizes, in theory, the emerging nonlinearity of battle, and some of its effects on sustainment.

> Nonlinear operations and unprecedented demand for resources are its [the AirLand Battlefield's] most salient features...To operate on this fluid AirLand Battlefield, forces must possess a higher degree of self-sustainability than ever before. They must be sustained by a support structure with mobility and speed which approaches their own.[67]

Nevertheless, the current organizations and doctrine for sustainment were developed for an essentially linear war scenario. Although its sustainment capabilities are substantial for such a scenario, they may not be configured effectively for the nonlinear battlefield.

Since the end of World War II, the most serious threat to the United States and our western European allies has been the Soviet Union. We have confronted each other essentially along the line where hostilities ended in 1945. The Soviet Union and her Warsaw Pact allies have maintained numerically superior forces with a significant offensive capability. The Western Alliance nations, though fewer in forces numerically, have elected to defend forward, depending upon superior technology and a highly developed infrastructure to enhance the inherent strength of the defense.

This essentially central European orientation of the U.S. Army since World War II has resulted in a very linear concept of support that is heavily dependent upon well-de-

veloped and secure lines of communication. This concept is expressed in current U.S. Army tactical sustainment, which is based upon six broad principles:

* Support must be continuous and adequate.

* CSS functions should be performed as far forward as possible.

* Roads, airlift, and other means of transportation must be fully exploited and controlled to overcome interdiction and congestion.

* Committed units must be supported by "push" packages rather than by requisition.

* CSS units and facilities must be positioned to support the operation, afford priority of support to the main effort, and must survive.

* Protection of CSS units should be planned in detail with self-protection and passive protection measures receiving special emphasis.[68]

In application, these principles may be reduced to three sustainment concepts: forward support, echelonment, and "push" sustainment. Providing support as far forward as possible is the end of tactical support; echelonment is its means; and "push" sustainment is the way it happens.

Forward support is based on the requirement to minimize the logistical burden on committed combat units. CSS elements bring supplies to those units and evacuate their personnel and equipment losses. Support troops free the fighters from those activities, permitting them to stay in contact and concentrate on the fight.

Echelonment of sustainment assigns or positions support elements close to the supported combat units, with assets

commensurate to the intensity and duration of the anticipated fight.[69] (Figure 2) A battalion task force, for example, has limited sustainment elements capable of emergency replenishment and evacuation for up to about twenty-four hours.[70] At brigade level, there are more robust support assets with the capability of replenishing the subordinate battalions for the next twenty-four to seventy-two hour period.[71] (Appendix) This reduces the battlefield clutter forward, provides greater security for the lightly armed, thin-skinned CSS elements, yet reduces the distances between the supported unit and its replenishment.

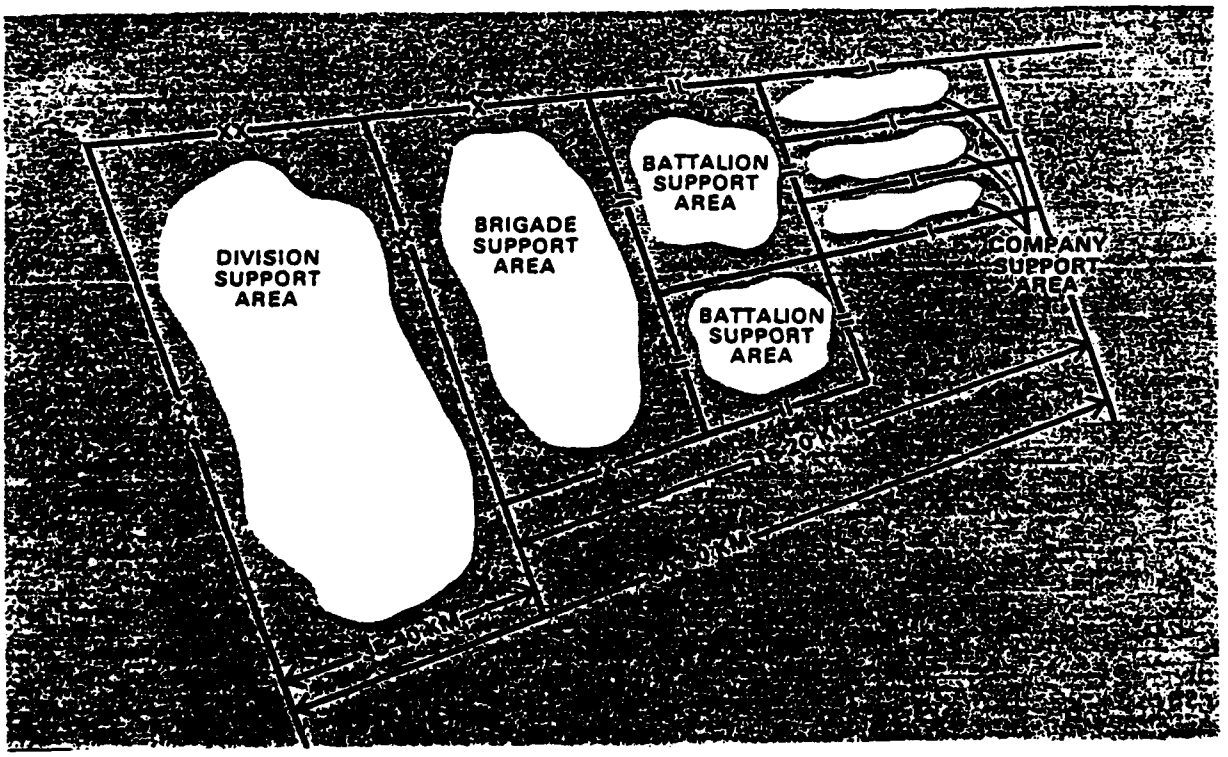

Figure 2. Current U.S. Army Echelonment of Sustainment. Reprinted from FM 63-2-2. Combat Service Support Operations: Armored, Mechanized, and Motorized Divisions, 3-8.

"Push" sustainment effects resupply and evacuation

between echelons. Modern battle does not permit the time for units to request their specific replenishment requirements from the rear and receive them in a timely manner. During World War II, the Army implemented the "push" system, in which common, anticipated items and quantities were pushed forward from the rear echelons to the next lower without requisition until the lower echelon was filled to capacity. In recent years, at the brigade level and below, this has consisted of LOGPACs of rations, fuel, ammunition, maintenance, and medical support. These move forward from the brigade support area (BSA) to restore the battalions' basic loads, recover or repair damaged equipment, and evacuate casualties.[72]

Current sustainment doctrine supports the sustainment imperatives of AirLand Battle quite well for the essentially linear battlefield for which it was developed. The CSS organizations are designed to provide support to meet the anticipated needs of supported units, as are the LOGPACs pushed forward from rear echelons. Doctrinally, sustainment organizations and plans are integrated into the concept of operation in order to best support the tactical mission. The "push" system and the redundancy of echelonment enhances continuity and responsiveness. Finally, the redundancy of assets by echelonment permits the depth required for effective improvisation.

However, though current doctrine recognizes the impact

of nonlinearity, it treats it as a special situation requiring unique sustainment considerations. Sustainment of deep maneuver, for example, "demands especially detailed sustainment planning because of its great risks. There are two ways in which deep maneuver can be sustained. The force can carry with it all the resources needed throughout the mission, or it can be sustained over a line of communications."[73] Similarly, units who may become bypassed and isolated may have to be self-sustaining until they can be relieved.[74]

The essentially linear, "push" orientation of current sustainment doctrine reveals several deficiencies and vulnerabilities for nonlinear battle. It assumes that well-developed, secure lines of communication between supporting rear echelons and forward supported units will be the norm. Thus, it does not anticipate the nature of the nonlinear battlefield or the increased requirement for integration of support for self-sufficiency of forward units. Without secure LOCs, forward units will quickly expend their limited sustainment assets, and the "push" system will be unable to replenish them. Both continuity and responsiveness of support will suffer. Finally, improvisation is degraded by limited means forward and limited ability to project forward from the rear.

The Israel Defense Forces (IDF) adopted the American "push" system during the 1960's.[75] Surrounded by their po-

tential enemies, and operating defensively on interior lines of support, such a sustainment system was imminently logical. However, as the IDF conducted deep maneuver operations during both the 1967 and 1973 Arab-Israeli Wars, they frequently found their forward maneuver units cut off from their supply columns. During the 1967 war, one armored brigade, advancing over a hundred miles through enemy territory, arrived at their objective with only nine tanks, as the rest ran out of fuel en route.[76] On several occasions, delays caused by the need to restore LOCs interrupted Israeli pursuits and exploitations.[77]

The Emerging Army Concept for Sustainment

The U.S. Army is currently refining the AirLand Battle concept of warfighting to adapt it to the increasing nonlinearity of warfare. AirLand Battle-Future (ALB-F) poses a battlefield on which enemy forces are detected at extreme distances and engaged by highly lethal and precise, long range air, missile, and artillery fires. After fires attrite the enemy, maneuver brigades attack from the rear of the corps area to complete their destruction. These brigades then move to a recovery site where they are reconstituted to prepare for future operations.[78]

The extreme ranges, precision, and lethality of emerging weaponry will require greater dispersion of forces on the battlefield and may greatly expand the distances between

the sustainment bases in the rear of the corps area, and the areas of operation of the maneuver brigades.[79] (Figure 3) The intervening space will be largely uncontrolled, and the likelihood of intermingling with dispersed and bypassed enemy elements is high.

The maneuver brigades will be combined arms columns with organic armor, infantry, artillery, engineers, and air defense. A forward support battalion (FSB) will support the brigade,[80] but the concept of support still strongly resembles current sustainment doctrine with many of the same vulnerabilities.

Forward support is still the object of the sustainment system.[81] In AirLand Battle-Future, however, most of the assets to conduct this support are found in the FSB at brigade level, pushing support as far forward as the weapons systems when needed.[82] Most of the battalion level organic sustainment assets will be moved to the FSB under the consolidation. Only very limited fuel and ammunition will remain in the battalions.[83] (Appendix) However, the battalion will continue to have an organic medical aid station, and a combat maintenance platoon from the FSB will be forward in the battalion combat trains.[84]

The FSB will not accompany the brigade to its objective area, but will be echeloned with a forward support area roughly thirty kilometers behind the maneuver units, and a rear support area which may be up to seventy kilometers

back.[85] (Figure 3) The forward support area will stock mobile rations, fuel, and ammunition supplies, as well as medical evacuation, maintenance recovery and contact teams, and tactical transportation for forward distribution of supplies.[86] The rear support area will have bulk storage of fuel, an ammunition transfer point, direct support maintenance for combat support units assigned to the brigade, and the medical clearing facility.[87]

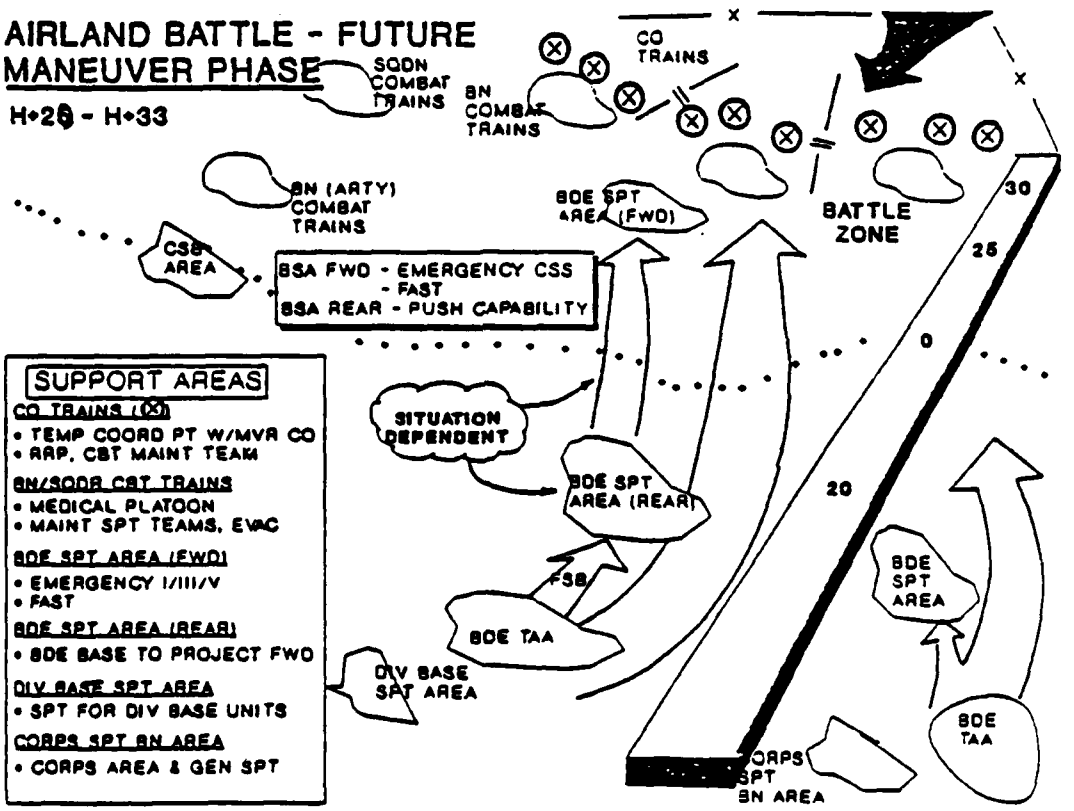

Figure 3. AirLand Battle-Future Sustainment Concept (Maneuver Phase). Reprinted from CACDA, "AirLand Battle Future Alternate Base Case Study, Phase IV," VI-A-10.

The next sustainment echelon above the FSB will be the corps. Under ALB-F, the division becomes a tactical command

and control headquarters to control a variable number of brigades. The only sustainment assets it will have are direct support elements for the division headquarters and limited divisional troops.[88] Replenishment for the brigades will come directly from corps support units, who will deliver supplies as far forward as the forward support area. There, fuel and ammunition will be transloaded to HEMTTs for distribution forward to the maneuver battalions and companies.[89] The "push" system still moves support forward according to anticipated requirements until forward units are full.[90]

If forward support, echelonment, and "push" sustainment remain under ALB-F, what has changed? Essentially, ALB-F sustainment has become more centralized and consolidated. Maneuver battalions give up most of their support platoon fuel, ammunition, and transportation assets to the FSB.[91] This was designed to "relieve the burden [of sustainment] from the maneuver battalion commander", in order to increase his mobility and flexibility.[92] Yet he has fewer assets with which to influence his fight and less endurance organic to his unit. Furthermore. this increases the amount of materiel that must be pushed forward from the brigade support areas along tenuous LOCs. Thus. the FSB has more to move farther than under the current structure. and the maneuver units are almost totally dependent upon the FSB for their support.

Though ALB-F as a warfighting concept is predicated upon nonlinear battle, the ALB-F sustainment concept is still very linear. It still pushes resources forward from rear echelons to forward maneuver units, along LOCs that admittedly pass through "potentially uncontrolled or unoccupied terrain which will emphasize the vulnerability of support operations."[93] The same vulnerabilities of current sustainment doctrine apply to ALB-F sustainment, but, if anything, the expanded distances and increased lethality of weapons make interdiction of support a greater threat than ever.

Though ALB-F sustainment may anticipate maneuver unit support requirements, it must also anticipate the enemy threat and battlefield conditions. In order to ensure forward support, it will be confronted with the same dilemma of LOCs--either dedicating CSS elements to accompany maneuver units or dedicating combat forces to secure the LOCs so that support can move forward. In either case, the maneuver commander assumes a logistical burden.

ALB-F does not integrate sustainment and maneuver. Indeed, a clear dichotomy is made between the two: "The maneuver commander will be free of logistics concerns in pursuing the battle. Forward Support Battalions will project support forward as needed based on mission, time, and distance."[94]

ALB-F sustainment will be continuous and responsive

only as long as LOCs remain open and secure. Greater improvisation will be required to fix problems over more extended distances and more widely dispersed support and supported units.

V. IMPLICATIONS

The mobility and lethality of the emerging nonlinear battlefield will limit the effectiveness of much of our current CSS structure. A flying column concept will require significant adaptation for sustainment organizations, equipment, and doctrine.

Organizations

Mission essential sustainment must accompany maneuver battalions and companies. At a minimum, fuel and ammunition must be immediately available to prevent even short pauses in the momentum of attack. Furthermore, immediate medical aid may be critical to dispersed units and damaged equipment may be quickly returned to battle if the right mechanic is available to diagnose and fix the problem, or to pull a vehicle out of immediate danger to where minor damage can be repaired.

Sustainment resources are always limited, and centralized visibility is desirable for efficiency. However, technology will increasingly permit us to centralize control and visibility without physical consolidation. Decentralization of assets permits the independence desired for the flying

column, while centralized control permits mutual and reinforcing support when needed.

Equipment

Given their proximity to combat, CSS assets must have mobility and survivability equal to the supported unit. Currently, most CSS vehicles are thin-skinned, wheeled vehicles. These are largely bound to improved roadways and will not withstand even small arms fire. Further development of armored logistics vehicles with true off road capability will greatly enhance the ability of CSS to be fully integrated into a maneuver column. Furthermore, logistics vehicles should be up-gunned to provide greater self-protection both during movement and at halts. Increasing the number of heavy machine guns and fielding the Mark 19-3 automatic grenade launcher would provide a capability to fight while sustaining.

To enhance speed of replenishment and reduced manpower requirements, logistics vehicles must be designed for rapid mechanical transfer of supplies. On board cargo cranes and the palletized load system (PLS) are two current innovations that demonstrate the benefits of this capability.

Supported unit equipment must be designed to be more sustainable. Soviet tanks are designed with at least twice the range of the American M1,[95] permitting them to reduce the fuel tail required in their flying columns. Liquid propellants and caseless ammunition will greatly reduce the

volume of accompanying ammunition. Combat equipment must be easily maintained with few tools, swapping out components rather than repairing or evacuating.

Doctrine

Accompanying support will require a more combat oriented sustainment concept. Sustainers will no longer move between a relatively secure rear echelon and forward trains. In the flying column, they will be part of a combined arms formation moving through potentially contested territory, looking for enemy forces to engage. Sustainers must be trained and equipped to fight as they sustain.

Echelonment of essential sustainment functions permits greater flexibility and responsiveness. Battalions must retain an organic sustainment capability to preclude operational halts. Brigade level assets must be in close enough proximity that they can quickly weight the main effort, and shift the priority of support almost instantly to capitalize on the developing situation.

Nonlinear Model

We need look no further than the current armored cavalry regiment (ACR) for a possible model upon which to construct a brigade level flying column. Cavalry has fought nonlinearily in both their covering force defensive role and as a force for pursuit and exploitation. As such, they are structured as a combined arms team that includes an organic

support squadron. The support squadron consists of fully mobile supply, maintenance, and medical assets,[96] designed to sustain the regiment without external support for about two days.[97] They supplement the armored cavalry squadron support platoons who maintain approximately one day of supplies beyond the basic loads of the troops.[98] (Appendix)

Certainly the support vehicles of the ACR will require enhanced mobility, firepower, and protection to remain viable on the AirLand Battlefield-Future. But it is significant that under ALB-F, the support structure of the ACR has not changed.[99] This implies recognition that nonlinear battle will require sufficient accompanying sustainment for a maneuver force operating over extended distances in an often independent role.

VI. CONCLUSION

Under the flying column concept, the scenario described in the introduction could have a different ending:

Even as the enemy survivors fled Objective HAMMER, armored logistics vehicles came alongside the depleted combat vehicles of the task force. A mechanical arm on the ammunition carriers exchanged the entire magazine of each fighting vehicle, while high pressure pumps on the fuel tankers filled refueled them within minutes.[100]

As the battle had raged, armored recovery vehicles pulled damaged vehicles and their crews to relative safety

out of direct fire of the enemy. Having feverishly swapped damaged components for spares, some of these vehicles were already returning to their platoons. The more seriously wounded crewmen were stabilized at the battalion aid station, and air ambulance helicopters were en route to take them directly to corps hospitals.

The MCS terminal directed a new objective ninety degrees from the previous line of march and fifty kilometers distant. After relaying brief mission orders to the subordinate commanders, the commander ordered the column to move out.

Technology has expanded the battlefield by developing more precise and lethal weapons, while shortening time through automation of information and speed of combat platforms. These have lead to a battlefield with no front, rear, or flanks, where opponents intermingle as they maneuver for advantage.

On such a nonlinear battlefield, the flying column has historically provided a self-sustainment capability to combat forces that permits them to exploit the tactical situation independent of fixed lines of communication. Characterized by independence, austerity, mobility, and security, flying column sustainment is tailored to the mission while ensuring that the sustainment imperatives of AirLand Battle are met.

The flying column offers a distinct alternative to

current and emerging U.S. Army sustainment concepts, which are still largely linear, dependent upon secure LOCs and "push" logistics. By contrast, the flying column integrates logistics requirements to permit independent operations.

As the Army grapples with how to fight on a nonlinear battlefield, the flying column offers a concept for sustainment that will allow independent maneuver and maintenance of momentum. Austere accompanying CSS down to battalion task force level will provide the endurance that is necessary to forestall culmination of an attack. However, efforts must be made to enhance the mobility and survivability of CSS assets to ensure that they do not degrade the agility of the force.

The materiel development requirements to implement the flying column may be significant. But the utility of accompanying sustainment for tactical formations offers dividends of both mobility and endurance that will be critical for victory in nonlinear battle.

Appendix: Comparison of Unit Fuel and Ammunition Capacities

CURRENT MANEUVER BRIGADE (Daily requirement vs capacity)

	FUEL (Gal)		AMMUNITION (STON)	
	Required	Capacity	Required	Capacity
M1 BN	38,231	30,000	80	100
BFV BN	17,467	12,600	60	149.5
FSB		55,400		550[1]
BDE TOTAL[2]	140,000	128,000	450	899.5

ALB-F MANEUVER BRIGADE

	FUEL (Gal)		AMMUNITION (STON)	
	Required	Capacity	Required	Capacity
M1 BN	38,231	5,000	80	20
BFV BN	17,467	5,000	60	20
FSB		129,000		786
BDE TOTAL[3]	140,000	135,000	450	846

ARMORED CAVALRY REGIMENT

	FUEL (Gal)		AMMUNITION (STON)	
	Required	Capacity	Required	Capacity
CAV SQN	38.231	22.500	80	70
SPT SQN		110.000		615
ACR TOTAL	160.000	211.700[4]	800	825

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[1] Handling capability only (MOADS): no organic distribution.

[2] 2 armor and 1 mech battalion.

[3] 2 armor and 1 mech battalion.

[4] Does not include aviation squadron fuel.

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